AC 2009-1372: A SURVEY OF MIDDLE-SCHOOL STUDENTS’ ATTITUDES TOWARD ENGINEERS AND SCIENTISTS

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A Survey of Middle Schoolers’ Attitudes towards Engineers and Scientists

Abstract

Do middle school students think they could become engineers, or think that engineering is boring? A set of surveys was used to assess the attitudes of 1010 middle school students about engineering and science. In general, the students perceived that engineers are more likely to do boring things, make peoples’ lives easier, and be good at math. Scientists were perceived as more likely to discover new knowledge, agree on the best way to solve problems, do many kinds of work, be creative, use lots of ways to communicate, and work with their brains. Responses also differed by gender. Female students indicated that scientists are more likely to make a lot of money, work alone, work with their hands, and get to be the boss. In contrast, the male students were more likely to associate these qualities with engineers. Analysis of constructed responses indicates both misconceptions and a lack of conceptions about engineering among the population surveyed.

Introduction

The broad objective of this research is to contribute to our understanding of middle school students’ attitudes towards engineering and science. Improving student awareness of engineering and science contributes to technological literacy among the general public and also helps students make informed career path decisions. A significant body of literature exists on the attitudes of K-12 students and teachers towards science and scientists. This literature has informed the development of science education outreach programs. However, a comparable body of literature about K-12 student attitudes towards engineering and engineers is not yet fully developed.

Some work has been done in this area. Yasar\textsuperscript{1} developed a survey to study K-12 teacher perceptions of engineering, primarily to determine their interest in and comfort level for teaching design, engineering and technology in their classrooms. Cunningham\textsuperscript{2} surveyed teachers to determine their conceptions of what engineers do. Recent research on K-12 student perceptions of engineers has been based upon student drawings\textsuperscript{3-9}. Drawings can be used to infer what a student believes engineers and their work environments look like. However, in the authors’ experiences, student drawings of engineers look a lot like people, and it is difficult to determine a student’s attitude towards the drawn engineer. For example, does the student think she or he could become an engineer, or think that engineering is boring? The study reported in this paper addresses questions such as these. Specifically, a survey was used to assess middle school student attitudes about engineers and engineering. The results are compared to a similar survey assessing student attitudes about scientists and science.

Study Design

To capture student attitudes, two surveys were designed. The first assessed student attitudes towards engineering while the second assessed attitudes towards science. The surveys were
designed and vetted by faculty members in middle school science education and mechanical engineering, and drew from literature and previous work in this area. Consideration was given to adopting the practice of changing the wording of questions so that respondents would be asked questions in a random positive-negative order. However, we have found through earlier work with 6-8th graders that positive-negative wording is sometimes confusing to students. Earlier, more complicated surveys of the type used in the current study frustrated many participants and resulted in a large number of incomplete surveys being collected. Hence each concept appears only once in the survey, and whether that concept was interpreted as positive or negative by the participants was not investigated.

As shown by the example in Figure 1, each survey had nineteen Likert scale questions and one open ended question. The wording of individual items was identical on both surveys, except engineers were the subject of one survey and scientists the subject of the other. For example, on the Engineer in Science Class (EISC) survey, students were asked to rate their agreement with the statement “Engineers make people’s lives better.” The parallel statement on the Scientist in Science Class (SISC) survey was “Scientists make people’s lives better.” Sixteen questions on each survey asked students about the characteristics of engineers or scientists, three questions asked about their personal attitudes towards engineering and science, and one question asked the student if she or he would like an engineer (or scientist) to help teach in their science classroom. This last question also asked “why or why not,” which invited a free response.

Approximately 1400 surveys were administered to sixth, seventh and eight grade students who attended public schools in or near a metropolitan area in the Southeastern United States with a population of about 350,000. Three of these schools were classified as urban, two as rural. Thirty-two classes were given the EISC survey and twenty-eight the SISC survey. Although a relatively large number of students were surveyed, this study is based upon a sample of convenience. The survey respondents were future participants in a National Science Foundation – funded Graduate Teaching Fellows in K-12 Education (GK-12) program at the authors’ institution.

The GK-12 program that is associated with this study provides fellowships to graduate students in engineering and in science to work one or two days a week in middle school science classrooms, enhancing science education through inquiry and design projects that support state education standards. Students in classrooms where engineering graduate students would work were given the EISC survey; students in classrooms with science graduate students were given the SISC survey. In both cases, the surveys were administered to the middle school students by the classroom teacher and before the GK-12 Fellow’s first visit to the classroom. Parental consent forms were distributed and collected, enabling an analysis of a total of 1010 surveys. Of these, 653 were engineer in the classroom surveys, and 357 were scientist in the class surveys.

Analysis

Student responses to the Likert-scale questions on the EISC and SISC surveys are summarized in Tables 1 and 2, respectively. A general observation is that on most questions on both surveys, students responses fell mostly in the agree and strongly agree categories. In addition, the students tended to disagree that engineers and scientists usually work alone, or do boring things.
**Directions:** Please read the following statements and tell whether you agree or disagree with them. Rate your responses 1 to 5, with 1 meaning "Strongly Disagree" and 5 meaning "Strongly Agree".

<table>
<thead>
<tr>
<th></th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Not Sure</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
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<td>5</td>
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<td>6.</td>
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<td>3</td>
<td>4</td>
<td>5</td>
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<tr>
<td>7.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
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<tr>
<td>8.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>9.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>10.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>11.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>12.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>13.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
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<tr>
<td>14.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>15.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>16.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

17. **Circle the sentence that fits you best:**
   - I love engineering.
   - I like engineering.
   - I don’t care about engineering.
   - I hate engineering.

18. **Circle the sentence that fits you best:**
   - I love science.
   - I like science.
   - I don’t care about science.
   - I hate science.

19. **Circle the sentence that fits you best:**
   - Last year I learned a lot in science class.
   - Last year I learned a little bit in science class.
   - Last year I learned nothing in science class.

20. **Would you like to have an Engineer help teach in your science classroom? Why or why not?**

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Figure 1. Survey used to gather perceptions of engineers among middle school students. A similar survey was used to gather perceptions of scientists, except that the word “engineer” was replaced with “scientist” in questions 1-16 and question 20.
<table>
<thead>
<tr>
<th>Engineers…</th>
<th>All 653 Students</th>
<th>Female Students</th>
<th>Male Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do many different kinds of work</td>
<td>1%</td>
<td>1%</td>
<td>1%</td>
</tr>
<tr>
<td>Are creative people</td>
<td>1%</td>
<td>1%</td>
<td>2%</td>
</tr>
<tr>
<td>Anyone can become one</td>
<td>6%</td>
<td>7%</td>
<td>6%</td>
</tr>
<tr>
<td>Make a lot of money</td>
<td>1%</td>
<td>1%</td>
<td>1%</td>
</tr>
<tr>
<td>Make people’s lives better</td>
<td>2%</td>
<td>3%</td>
<td>2%</td>
</tr>
<tr>
<td>Do boring things</td>
<td>25%</td>
<td>20%</td>
<td>22%</td>
</tr>
<tr>
<td>Need to be good problem solvers</td>
<td>3%</td>
<td>2%</td>
<td>3%</td>
</tr>
<tr>
<td>Agree on the best way to solve a problem</td>
<td>9%</td>
<td>9%</td>
<td>9%</td>
</tr>
<tr>
<td>Use lots of ways to communicate ideas</td>
<td>1%</td>
<td>1%</td>
<td>1%</td>
</tr>
<tr>
<td>Need to be good at math</td>
<td>2%</td>
<td>2%</td>
<td>2%</td>
</tr>
<tr>
<td>Work with their hands</td>
<td>1%</td>
<td>1%</td>
<td>1%</td>
</tr>
<tr>
<td>Get to be the boss</td>
<td>9%</td>
<td>11%</td>
<td>7%</td>
</tr>
<tr>
<td>Discover new knowledge</td>
<td>2%</td>
<td>2%</td>
<td>2%</td>
</tr>
<tr>
<td>Design new things</td>
<td>2%</td>
<td>2%</td>
<td>2%</td>
</tr>
<tr>
<td>Usually work alone</td>
<td>19%</td>
<td>17%</td>
<td>22%</td>
</tr>
<tr>
<td>Love Like Don't Care</td>
<td>Love Like Don't Care Love Like Don't Care Love Like Don't Care</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I… engineering</td>
<td>11%</td>
<td>5%</td>
<td>17%</td>
</tr>
<tr>
<td>I… science</td>
<td>34%</td>
<td>35%</td>
<td>33%</td>
</tr>
<tr>
<td>A Lot A Little A Nothing</td>
<td>A Lot A Little A Nothing A Lot A Little A Nothing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Last year, I learned…. In science</td>
<td>72%</td>
<td>74%</td>
<td>71%</td>
</tr>
<tr>
<td>Would like an engineer to help teach</td>
<td>78%</td>
<td>77%</td>
<td>79%</td>
</tr>
</tbody>
</table>
Table 2. Summary of 357 middle school students’ responses to the Scientists in Science Class Survey.

<table>
<thead>
<tr>
<th>Scientists…</th>
<th>SD</th>
<th>D</th>
<th>NS</th>
<th>A</th>
<th>SA</th>
<th>SD</th>
<th>D</th>
<th>NS</th>
<th>A</th>
<th>SA</th>
<th>SD</th>
<th>D</th>
<th>NS</th>
<th>A</th>
<th>SA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do many different kinds of work</td>
<td>1%</td>
<td>1%</td>
<td>6%</td>
<td>38%</td>
<td>53%</td>
<td>0%</td>
<td>0%</td>
<td>7%</td>
<td>40%</td>
<td>53%</td>
<td>3%</td>
<td>2%</td>
<td>6%</td>
<td>35%</td>
<td>54%</td>
</tr>
<tr>
<td>Are creative people</td>
<td>2%</td>
<td>1%</td>
<td>11%</td>
<td>45%</td>
<td>40%</td>
<td>2%</td>
<td>1%</td>
<td>13%</td>
<td>44%</td>
<td>40%</td>
<td>2%</td>
<td>2%</td>
<td>8%</td>
<td>45%</td>
<td>43%</td>
</tr>
<tr>
<td>Anyone can become one</td>
<td>7%</td>
<td>10%</td>
<td>29%</td>
<td>29%</td>
<td>24%</td>
<td>6%</td>
<td>7%</td>
<td>32%</td>
<td>30%</td>
<td>25%</td>
<td>9%</td>
<td>11%</td>
<td>28%</td>
<td>29%</td>
<td>22%</td>
</tr>
<tr>
<td>Make a lot of money</td>
<td>2%</td>
<td>1%</td>
<td>49%</td>
<td>26%</td>
<td>21%</td>
<td>0%</td>
<td>1%</td>
<td>52%</td>
<td>26%</td>
<td>20%</td>
<td>4%</td>
<td>1%</td>
<td>46%</td>
<td>24%</td>
<td>23%</td>
</tr>
<tr>
<td>Make people’s lives better</td>
<td>6%</td>
<td>7%</td>
<td>25%</td>
<td>37%</td>
<td>24%</td>
<td>6%</td>
<td>6%</td>
<td>24%</td>
<td>36%</td>
<td>26%</td>
<td>7%</td>
<td>7%</td>
<td>25%</td>
<td>38%</td>
<td>22%</td>
</tr>
<tr>
<td>Do boring things</td>
<td>33%</td>
<td>38%</td>
<td>16%</td>
<td>7%</td>
<td>3%</td>
<td>26%</td>
<td>41%</td>
<td>16%</td>
<td>8%</td>
<td>3%</td>
<td>43%</td>
<td>31%</td>
<td>15%</td>
<td>5%</td>
<td>3%</td>
</tr>
<tr>
<td>Need to be good problem solvers</td>
<td>4%</td>
<td>6%</td>
<td>20%</td>
<td>39%</td>
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<td>4%</td>
<td>6%</td>
<td>21%</td>
<td>39%</td>
<td>30%</td>
</tr>
<tr>
<td>Agree on the best way to solve a problem</td>
<td>6%</td>
<td>14%</td>
<td>29%</td>
<td>27%</td>
<td>23%</td>
<td>5%</td>
<td>15%</td>
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<td>26%</td>
<td>22%</td>
<td>7%</td>
<td>12%</td>
<td>28%</td>
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<td>23%</td>
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<td>Use lots of ways to communicate ideas</td>
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<td>17%</td>
<td>51%</td>
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<td>4%</td>
<td>2%</td>
<td>18%</td>
<td>48%</td>
<td>28%</td>
</tr>
<tr>
<td>Need to be good at math</td>
<td>2%</td>
<td>6%</td>
<td>18%</td>
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<td>37%</td>
<td>1%</td>
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<td>2%</td>
<td>7%</td>
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<td>41%</td>
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<tr>
<td>Work with their hands</td>
<td>1%</td>
<td>1%</td>
<td>15%</td>
<td>41%</td>
<td>40%</td>
<td>0%</td>
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<td>2%</td>
<td>2%</td>
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<td>36%</td>
</tr>
<tr>
<td>Work with their brains</td>
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<td>6%</td>
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<td>2%</td>
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<td>62%</td>
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<tr>
<td>Get to be the boss</td>
<td>15%</td>
<td>20%</td>
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<td>7%</td>
<td>5%</td>
<td>10%</td>
<td>22%</td>
<td>55%</td>
<td>9%</td>
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<td>20%</td>
<td>17%</td>
<td>49%</td>
<td>6%</td>
<td>8%</td>
</tr>
<tr>
<td>Discover new knowledge</td>
<td>1%</td>
<td>2%</td>
<td>13%</td>
<td>48%</td>
<td>37%</td>
<td>1%</td>
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<td>40%</td>
<td>1%</td>
<td>3%</td>
<td>10%</td>
<td>49%</td>
<td>36%</td>
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<tr>
<td>Design new things</td>
<td>2%</td>
<td>2%</td>
<td>14%</td>
<td>46%</td>
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<td>1%</td>
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<td>2%</td>
<td>12%</td>
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<tr>
<td>Usually work alone</td>
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<td>24%</td>
<td>46%</td>
<td>8%</td>
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<table>
<thead>
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<th>Love</th>
<th>Like</th>
<th>Don’t Care</th>
<th>Hate</th>
<th>Love</th>
<th>Like</th>
<th>Don’t Care</th>
<th>Hate</th>
<th>Love</th>
<th>Like</th>
<th>Don’t Care</th>
<th>Hate</th>
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<td>5%</td>
<td>6%</td>
<td>45%</td>
<td>42%</td>
<td>6%</td>
<td>25%</td>
<td>48%</td>
<td>22%</td>
</tr>
<tr>
<td>science</td>
<td>20%</td>
<td>71%</td>
<td>6%</td>
<td>2%</td>
<td>21%</td>
<td>72%</td>
<td>4%</td>
<td>3%</td>
<td>19%</td>
<td>70%</td>
<td>7%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>A Lot</th>
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<th>Nothing</th>
<th>A Lot</th>
<th>A Little</th>
<th>Nothing</th>
<th>A Lot</th>
<th>A Little</th>
<th>Nothing</th>
</tr>
</thead>
<tbody>
<tr>
<td>a lot</td>
<td>little</td>
<td>no thing</td>
<td>a lot</td>
<td>little</td>
<td>no thing</td>
<td>a lot</td>
<td>little</td>
<td>no thing</td>
</tr>
</tbody>
</table>

| Last year, I learned… | In science | 68% | 28% | 3% | 70% | 27% | 3% | 65% | 30% | 2% |

<table>
<thead>
<tr>
<th>Yes</th>
<th>Not Sure</th>
<th>No</th>
<th>Yes</th>
<th>Not Sure</th>
<th>No</th>
<th>Yes</th>
<th>Not Sure</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>82%</td>
<td>3%</td>
<td>8%</td>
<td>84%</td>
<td>4%</td>
<td>7%</td>
<td>78%</td>
<td>4%</td>
<td>9%</td>
</tr>
</tbody>
</table>
A large number of students were not sure if engineers and scientists make a lot of money. These observations indicate a general level of similarity in the students’ perceptions of engineers and scientists. However, on 13 of the first 16 survey questions, the EISC surveys contained noticeably more responses in the not sure category than did the SISC survey.

To facilitate the analysis of the data, the Likert responses were numerically coded. For the first sixteen questions about perceptions of engineers and scientists, the values ranged from 1 (representing strongly disagree) to 5 (representing strongly agree), consistent with the example survey shown in Figure 1. For questions 17 and 18, which addressed student feelings towards engineering and science, the values of 1, 2, 3 and 4 represent love, like, don’t care and hate, respectively. For question 19 about science learning last year, the values of 1, 2 and 3 represent response categories of a lot, a little and nothing. Question 20 was an open ended question that asked the students to explain why they would or would not want an engineer or scientist to help teach in their science classrooms. Here, the written responses were analyzed and coded as 1, 2, or 3 if the student’s answers indicated an answer of yes, not sure, or no, respectively.

The numerically coded Likert scale responses were used to calculate a mean response for each question on each survey. These mean values were calculated for all responses. In addition, the fact that student names were collected on each survey enabled an analysis of responses by gender; after data collection, the GK-12 Fellow for each classroom was given a list of the student names extracted from the surveys. The Fellow identified the gender of each student. The authors used this data to compare the responses of female and male students.

Differences in student responses were compared for statistical significance using the Mann-Whitney U test (also called the Wilcoxon rank-sum test), a non-parametric test for assessing two observations. In this research, it was used to test for differences in medians of the populations. This test assumes that the two populations are independent and continuous. In this study, a Mann-Whitney result of a small p-value (p<0.05) was interpreted as strong evidence that the medians of the two data samples are not equal. In the following discussion, claims of statistical significances are based on this interpretation.

Results

Mean responses of female students and male students to the EISC and SISC surveys are shown in Figure 2. In this figure, the questions are sorted according to the mean response on the EISC survey, so that the question with strongest agreement (engineers work with their brains) appears at the top of the plot, and the question with the strongest disagreement (engineers do boring things) appears at the bottom. Figure 1 indicates similar trends in responses to the two surveys.

To better illustrate the differences in the responses to the EISC and SISC surveys, the differences in the mean values for each question were calculated and are shown graphically in Figure 3. A positive difference indicates that the mean value on the EISC survey was greater than the corresponding mean on the SISC survey. By testing the underlying data for statistical significance, the results show that the population surveyed perceives that engineers are more likely to do boring things, make peoples’ lives easier, and need to be good at math. Scientists are perceived as more likely to discover new knowledge, agree on the best way to solve problems,
do boring things
usually work alone
good problem solvers
make peoples lives easier
use lots of ways to communicate
discuss new knowledge
agree on best way to solve problem
get to be the boss
usually work alone
do boring things

Mean Response: All Students

engineers

scients

* do boring things
* make peoples lives easier
* good at math
* do many kinds of work
* design new things
* good problem solvers
* get to be the boss

anyone can be one
work with their hands
work with their brains
make a lot of money
use lots of ways to communicate
are creative people
do many kinds of work
agree on best way to solve problem
discover new knowledge

-0.5 -0.4 -0.3 -0.2 -0.1 0 0.1 0.2 0.3 0.4 0.5

Difference in Mean Response (Eng-Sci): All Students

engineers

scients

* do boring things
* make peoples lives easier
* good at math
* do many kinds of work
* design new things
* good problem solvers
* get to be the boss

anyone can be one
work with their hands
work with their brains
make a lot of money
use lots of ways to communicate
are creative people
agree on best way to solve problem
discover new knowledge

-0.5 -0.4 -0.3 -0.2 -0.1 0 0.1 0.2 0.3 0.4 0.5

Difference in Mean Response (Eng-Sci): Female Students

Mean Response: Female Students

engineers

scients

* do boring things
* make peoples lives easier
* good at math
* do many kinds of work
* design new things
* good problem solvers
* get to be the boss

anyone can be one
work with their hands
work with their brains
make a lot of money
use lots of ways to communicate
are creative people
agree on best way to solve problem
discover new knowledge

-0.5 -0.4 -0.3 -0.2 -0.1 0 0.1 0.2 0.3 0.4 0.5

Difference in Mean Response (Eng-Sci): Male Students

Mean Response: Male Students

engineers

scients

* do boring things
* make peoples lives easier
* good at math
* do many kinds of work
* design new things
* good problem solvers
* get to be the boss

anyone can be one
work with their hands
work with their brains
make a lot of money
use lots of ways to communicate
are creative people
agree on best way to solve problem
discover new knowledge

-0.5 -0.4 -0.3 -0.2 -0.1 0 0.1 0.2 0.3 0.4 0.5

Difference in Mean Response (Eng-Sci): Male Students

Mean Response: Male Students

engineers

scients

* do boring things
* make peoples lives easier
* good at math
* do many kinds of work
* design new things
* good problem solvers
* get to be the boss

anyone can be one
work with their hands
work with their brains
make a lot of money
use lots of ways to communicate
are creative people
agree on best way to solve problem
discover new knowledge

-0.5 -0.4 -0.3 -0.2 -0.1 0 0.1 0.2 0.3 0.4 0.5

Difference in Mean Response (Eng-Sci): Male Students

Mean Response: Male Students

engineers

scients

* do boring things
* make peoples lives easier
* good at math
* do many kinds of work
* design new things
* good problem solvers
* get to be the boss

anyone can be one
work with their hands
work with their brains
make a lot of money
use lots of ways to communicate
are creative people
agree on best way to solve problem
discover new knowledge

-0.5 -0.4 -0.3 -0.2 -0.1 0 0.1 0.2 0.3 0.4 0.5

Difference in Mean Response (Eng-Sci): Male Students

Mean Response: Male Students
do many kinds of work, be creative, use lots of ways to communicate, make a lot of money, and work with their brains.

Figures 4 and 5 present the results from the female students in the populations. The female students tended to give higher ratings for the scientist than the engineer in all categories except being good at math and doing boring things. Figures 6 and 7 present comparable results for the male students. A comparison of Figure 6 to Figure 4 indicates that the trends in the different questions are similar for males and females. However, as shown in Figure 7, males tended to give higher ratings for the engineers than the scientist.

There are differences in the responses of male and female students that are noteworthy and can be observed by comparing Figures 5 and 7. Both groups provided similar responses on many questions, but not all. Specifically, the female students indicated that scientists are more likely to make a lot of money, work alone, work with their hands, and get to be the boss. In contrast, the male students were more likely to associate these qualities with engineers. The cause of these differences in perceptions of scientists and engineers would be worth exploring.

Survey questions 17, 18 and 19 attempt to address student attitudes towards engineering and science. Since these questions were the same on both the EISC and SISC survey, the responses of the total population were combined for analysis. The results shown for question 19 in Figure 8 indicate that most students in the population (>70%), regardless of gender, reported that they had learned a lot in science class last year. Very few (<3%) indicated they had learned nothing. The female and male students were therefore similar in the attitudes towards science learning.

This similarity is also evident in the responses to question 18. About 60% of both female and male students reported that they liked science, and 30% that they loved science. About twice as many males reported that they didn’t care about science than females (7% versus 4%). Figure 9 compares these results to those obtained for the similar question about attitudes towards engineering. Several differences are striking. A much larger percentage of students reported that they do not care about engineering than did for science. This includes 40% of the female population surveyed. Also, 20% percent of the males reported that they loved engineering, compared to about 5% of the females.

Discussion

Student responses to the open-ended question “Would you like to have an engineer help teach in your science classroom?” provides insight into interpreting the results from the other questions about student perceptions and student feelings. The written responses were categorized into emergent themes by the authors. The most common explanation given by students as to why they would like to have an engineer help teach in their science classroom was to learn more about engineering. However, many of the comments from the students indicated misconceptions about engineers. A representative student wrote “Yes, I would want an engineer to teach in my science classroom because they can teach us a lot about how they work, what do they change in cars and things like that.” The reference to changing cars implies a conception of an engineer as a mechanic. The second and third most frequent explanation provided by students was they
Last year, I learned ___ in science.

Figure 8. Student attitudes towards science learning

I ____ engineering. I ____ science.

Figure 9. Student attitudes towards engineering and science.

Engineer help teach? Scientist help teach?

Figure 10. Student attitudes towards engineers and scientists in the classroom.
would learn a lot of new things and that the engineer would know more or do a better job than
the teacher. About 15% of students indicated each of these responses.

As shown, a much smaller portion of the students surveyed indicated that they did not want an
engineer help teach in their classroom. Of these students, their responses indicated that about
25% did not like or did not care about engineering, and about 25% indicated that an engineer in
the classroom would not be any help to them. It is interesting that almost 50% of the students
that did not want an engineer in their class explained that engineers do not know science or that
they did not know what an engineer is. For example, students commented "No, I would not
because engineers deal with math not science" and "No, because I do not know if they can teach
about science." This points to both misconceptions and a lack of conceptions about engineering.

Conclusion

Middle school students were surveyed to assess their attitudes towards engineers and scientists.
Responses indicate students believed that engineers and scientists share many of the same
qualities. However, differences were found in the perceptions of female students and male
students. As discussed, female students indicated that scientists are more like to make a lot of
money, work alone, work with their hands, and get to be the boss. In contrast, the male students
were more likely to associate these qualities with engineers. Survey responses indicated less
certainty about what the qualities of engineers for both males and females. A positive finding is
that many students indicated that they would like to know more about engineering.

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